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Remarks/Arguments:

Applicant wishes to thank the Examiner for her detailed comments. As Examiner has grouped her actions by sections, Applicant will respond to these
5 sections one by one.

Claim Rejections –35USC § 103:

Examiner has stated that:

10 "Claims 1, 5-10 are rejected under 35 U.S.C. 103(a) as being obvious over *Halahan* (US 6,897,148) in view of *Siniaguine* (US 6498074).

15 "As for claim 1, *Halahan* discloses a method for fabricating heads of disk drive assemblies, comprising a Si wafer (Fig. 4, 110) which has been fabricated with a SiO₂ overcoat (120); depositing a layer of DRIE-resistant material (FIG. 15, 1010.1) on said SiO₂ overcoat (120); depositing a patterned layer of RIE-resistant material (1010.3) on said layer of DRIE-
resistant material to form a primary mask.

"*Halahan* discloses etching by RIE (Fig. 15 and col. 8, 21-24, col.10, 5-6) through said primary mask (Fig. 15, 1010.3) to pattern said SiO₂ (Fig. 15, 120) overcoat layer and said layer of DRIE-resistant material (Fig. 1010.1).

20 "*Halahan* discloses removing said primary mask (Fig. 15, 1010.3) to expose said layer of DRIE-resistant material (Fig. 15, 1010.1) which has now been patterned to form a secondary mask (col.8, 62-64); etching by DRIE through said secondary mask (Fig. 15, 120) to cut said Si wafer (Fig. 22 and Fig. 5, or col. 4 15-25); and removing said secondary mask (Fig. 15, 120)...."

25 For the record, Applicant does not agree that *Halahan* discloses "depositing a layer of DRIE-resistant material (FIG. 15, 1010.1)". In Fig. 15, the seed layer consists of two sub-layers **1010.1**, and **1010.2**. The bottom layer is a .02um layer of TiW. The top layer **1010.2** is a 1 um layer of copper. The copper provides a low resistance to obtain a uniform electrical potential across the wafer during the ED resist deposition. The TiW layer improves copper adhesion." (col.8, lines 49-57)

30 As stated before, due to its low mask selectivity rating, those skilled in the art would not understand TiW to be useful as a DRIE-resistant masking material.

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In addition, *Halahan* does not disclose a two part method using a layer of DRIE-resistant material followed by a patterned layer of RIE-resistant material, then etching by RIE through the RIE-resistant material primary mask to pattern the layer of DRIE-resistant material, and then etching by DRIE through the DRIE-resistant material. To do this requires two masks and two separate etching processes with different resistant materials. *Halahan* does not disclose this.

5 In fact, Examiner even admits below in the section pertaining to rejection of Claims 11-13 and 15-20 that:

10 "The combined teachings of *Halahan* and *Siniaguine* failed to teach etching by RIE through said RIE mask to pattern the SiO₂ overcoat layer and form a DRIE mask removing mask to expose DRIE mask; from said DRIE-resistant material; etching by DRIE through said DRIE mask; removing DRIE mask." (Final Office Action dated 3/2/06, Page 6, lines 9-12)

15 The admitted failure of these combined teachings applies to Claim 1 and its dependent claims as well as to Claim 11 and its dependents.

20 However, this point is now moot, as the cited references definitely do not recite:

"depositing a layer of DRIE-resistant material on said SiO₂ overcoat, wherein said DRIE-resistant material is Al₂O₃"

as in the amended Claim 1.

25 Applicant respectfully asserts that independent Claim 1, as amended, includes the feature of a DRIE-resistant Al₂O₃ layer which is not taught nor suggested in *Halahan*, nor any of the cited references, either alone or in combination. Therefore it cannot be fairly said that the present invention as

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claimed in Claim 1 is obvious over *Halahan* in view of *Siniaguine*, or any other cited art. Applicant therefore respectfully requests that the rejection be withdrawn and Claim 1 be allowed.

5 Examiner has further stated:

"As for claim 5, *Halahan* discloses the use of the DRIE-resistant material, is the SiO₂ overcoat as the DRIE-resistant material (shown in fig. 16)."

In the claims as amended, Claim 5 is canceled, and Claim 1, as amended,
10 includes the limitation of the former Claim 5, namely that the DRIE-resistant material is Al₂O₃. Therefore, the examiner's rejection of the combination of Claim 5 and Claim 1 will be addressed here.

Applicant does not agree with the characterization of SiO₂ as a DRIE-resistant material.

15 Further, the Examiner's comment that *Halahan* uses a SiO₂ overcoat is irrelevant, since the previous claim 5 and now amended Claim 1 calls for the use of Al₂O₃ as the DRIE-resistant material.

Furthermore, since the currently amended Claim 1 contains only the limitations that were previously presented in the (now canceled) Claim 5, no new
20 matter has been introduced, and no new search is required.

As for claim 6, *Halahan* discloses depositing a patterned layer of RIE-resistant material (fig. 10, 1010.3) on said layer of DRIE-resistant material (fig. 10, 1010.1) to form a primary mask comprises; applying, exposing developing photo resist (col. 3, to create the pattern (col. 3, 1.39 masked is written on pattern); plating the layer of RIE-resistant material into the photo-resist pattern (col. 7, 1.42-25 "other process can also be used is written on plating the layer); and stripping the photo-resist (see fig. 16).

25 "As for claim 7, *Halahan* discloses applying a seed layer 1010.3) of resistant material before applying said photo resist (fig. 16, 11 10). As for claim 8, *Halahan* discloses first sputter etching away said seed layer (col. 5, 33-35 "any suitable technique" is written on sputter-etching)

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of RIE-resistant material before RIE.

"As for claims 9-10, *Halahan* discloses removing primary mask by selective wet etching (see col. 8,

5 Again, for the record, Applicant does not agree that *Halahan* discloses depositing a patterned layer of RIE-resistant material on the layer of DRIE-resistant material.

10 *Halahan* does not disclose a two part method using a layer of DRIE-resistant material followed by a patterned layer of RIE-resistant material, and then etching by RIE through the RIE-resistant material primary mask to pattern the layer of DRIE-resistant material, and then etching by DRIE through the DRIE-resistant material. To do this requires two masks and two separate etching processes with different resistant materials. *Halahan* does not disclose this.

15 However, this point is now moot, as the cited references definitely do not recite:

"depositing a layer of DRIE-resistant material on said SiO₂ overcoat, wherein said DRIE-resistant material is Al₂O₃"

as in the amended Claim 1.

20 Applicant respectfully asserts that independent Claim 1, as amended, includes the feature of a DRIE-resistant Al₂O₃ layer which is not taught nor suggested in *Halahan*, nor any of the cited references, either alone or in combination. Therefore it cannot be fairly said that the present invention as claimed in Claim 1 is obvious over *Halahan* in view of *Siniaguine*, or any other cited art. Likewise, neither reference, nor any combination of cited references, 25 includes the elements of the claimed invention as found in dependent claims 6-10, (claim 5 is now cancelled) which all inherit the assertedly novel feature of

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“depositing a layer of DRIE-resistant material on said SiO₂ overcoat, wherein said DRIE-resistant material is Al₂O₃”

from Claim 1, and the combination cannot be said to be obvious in view of them.

Applicant therefore respectfully requests that the rejections be withdrawn
5 and Claims 6-10 be allowed.

Claim Rejections –35 USC § 103:

Examiner has stated that:

10 “Claims 2-4 are rejected under 35 U.S.C. 103(a) as being obvious over *Halahan* and *Siniaguine* in view of *Matono* (US 6,477,019).
 “...*Halahan* did not chose from the group consisting of Al₂O₃ for the **RIE-resistant** material.” (emphasis added)

15 “It would have been obvious to one ordinary skill in the art at the time of invention was made, to combine the method of cutting wafers into individual pieces using plasma etch, of *Halahan* and *Siniaguine*, with the use of alumina as a **RIE-resistant** material.” (emphasis added)
 “... as taught by *Matono*, because *Matono* teaches the layer of alumina can be selectively patterned vertically, when using **reactive plasma methods**” (emphasis added)....”

20 Applicant respectfully points out that Al₂O₃ is used as a **DRIE-resistant** masking material. Examiner seems to be confusing RIE (Reactive Ion Etching) and DRIE (Deep Reactive Ion Etching) processes, and seems to regard them as interchangeable. They are not. The very fact that two different masks of different materials are used for the two different processes should make it clear that they are
25 not equivalent, and cannot be regarded as such when analyzing the prior art.

Further, the mere mention of alumina as a material for magnetic gap layers does not teach the use of it as a secondary, or even primary, DRIE mask in the

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cited reference.

As pointed out above, Examiner even admits below in the section pertaining to rejection of Claims 11-13 and 15-20 that:

5 "The combined teachings of *Halahan* and *Siniaguine* failed to teach etching by RIE through said RIE mask to pattern the SiO₂ overcoat layer and form a DRIE mask removing mask to expose DRIE mask; from said DRIE-resistant material; etching by DRIE through said DRIE mask; removing DRIE mask." (Final Office Action dated 3/2/06, Page 6, lines 9-12)

10 Applicant again asserts that the admitted failure of these combined teachings applies to Claim 1 and its dependent claims as well as to Claim 11 and its dependents.

Thus, the feature of forming a secondary mask of DRIE-resistant material, which is Al₂O₃, along with a primary mask of RIE-resistant material as claimed in
15 Claim 1 is not found in any reference, nor any combination of cited references. Claims 2-4 all inherit these assertedly novel features from Claim 1, and the combination cannot be said to be obvious in view of them. Applicant therefore respectfully requests that the rejections be withdrawn and Claims 2-4 be allowed.

20 **Claim Rejections -35USC § 103:**

Examiner has stated that:

25 "Claims 11-13, 15-20 are rejected under 35 U.S.C. 103(a) as being obvious over *Halahan* and *Siniaguine* (see discussion above) in view of *Matono* (see discussion above) and *Mandal* et al. (USPN 6,171,945).

"The combined teachings of *Halahan* and *Siniaguine* failed to teach etching by RIE through said RIE mask to pattern the SiO₂ overcoat layer and form a DRIE mask removing mask to expose DRIE mask; from said DRIE-resistant material; etching by DRIE through said DRIE mask; removing DRIE mask."

30 "...*Mandal* teaches....form a DRIE mask (Fig. 8F, 514)..."

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The element **514** of Fig. 8 is referred to as a “hydrogenated silicon carbide etch stop **514**”. This material is not known as a DRIE-resistant material to those skilled in the art. In fact, Applicant can find no reference to DRIE processes in this cited patent at all.

5 Claim 11, as currently amended, states:

“..depositing a layer of DRIE-resistant material on said SiO₂ overcoat, wherein said DRIE-resistant material is Al₂O₃...”

This feature is not found in any of the *Halahan*, *Siniaguine*, *Matono* or
10 *Mandel* references nor in any combination of the cited prior art.

Therefore it cannot be fairly said that the present invention as claimed in
Claim 11 is obvious over *Halahan* and *Siniaguine* in view of *Matono* and *Mandel*.

Likewise, neither reference, nor any combination of cited references,
includes the elements of the claimed invention as found in dependent claims 12-20,
15 which all inherit these assertedly novel features from Claim 11, and the
combination cannot be said to be obvious in view of them. Applicant therefore
respectfully requests that the rejections be withdrawn and Claims 11-13 and 16-20
(15 now canceled) be allowed.

20 **Claim Rejections –35USC § 103:**

Examiner has stated that:

“Claim 14 is rejected under 35 U.S.C. 103(a) as being obvious over *Halahan* and
Siniaguine ... in view of *Matono* ... *Mandal* and *Sheplak* (USPN 6,018,861).

25 “...*Sheplak* et al. teaches a method of forming micro-sensor thin-film anemometer I
which copper is used as a hard mask...”

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As before, there is still no mention of a DRIE-mask in any of these references. Copper has been discussed instead as a material for an RIE mask. Once again, Examiner seems to be confusing RIE (Reactive Ion Etching) and DRIE (Deep Reactive Ion Etching) processes, and seems to regard them as 5 interchangeable. Therefore it cannot be fairly said that the present invention as claimed in Claim 11 is obvious over *Halahan* and *Siniaguine* in view of *Matono*, *Mandal* and *Sheplak*.

More specifically, Claim 11, as currently amended, states:

10 “..depositing a layer of DRIE-resistant material on said SiO₂ overcoat, wherein said DRIE-resistant material is Al₂O₃...”

This feature is not found in any of the *Halahan*, *Siniaguine*, *Matono*, *Mandal* or *Sheplak* references nor in any combination of the cited prior art.

Therefore it cannot be fairly said that the present invention as claimed in 15 Claim 11 is obvious over *Halahan* and *Siniaguine* in view of *Matono* and *Mandal*.

Likewise, neither reference, nor any combination of cited references, includes the elements of the claimed invention as found in dependent Claim 14, which all inherit these assertedly novel features from Claim 11, and the combination cannot be said to be obvious in view of them. Applicant therefore 20 respectfully requests that the rejections be withdrawn and Claim 14 be allowed.

Response to Response to Response to Arguments

Examiner has stated:

25 “Throughout the remarks, filed on 12/01/05, applicants repeatedly argue that secondary references do not reference the term DRJE, (as in page 7, 8, and 9) when the primary reference (*Halahan* et al USPN 6,897,148) clearly states "the opening may be formed by a masked etch, a laser, or in any other way known or to be invented, in one embodiment, a deep reactive ion etch

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(DRIE) is use...".

"Applicants argue, on page 10 that "...those skilled in the art would not understand to be useful as a masking material." Examiner maintains that *Halahan* et al. of USPN 6,897,148 clearly shows TiW is used as a DRIE-resistant masking material. Although the reference may

5 never explicitly uses the term "mask", the reference illustrates that the layer functions as a mask to the layer under it by simple concealment. Applicants argue, on page 8" (should be 10) "that silicon carbide is not known as a DRIE resistant material. Examiner disagrees for the same reasons stated above and maintains *any material used as a stop must be resistant to the etch, therefore a DRIE resistant material.*" (emphasis added)

10

Examiner is reminded that the method of the present invention uses both RIE and DRIE, with primary and secondary masks for each of the two processes. The use of the two separate processes used with appropriate masking materials for each separate process cannot be inferred merely from a list of etching processes, which happens to include DRIE as one of them. Nor is it appropriate to find each process used separately in separate references and assert that it is obvious to combine both processes with their appropriate masking materials into one method. There are specific material and processing choices that have to be made in such a combination, which are addressed by the present invention, but not contemplated by any of the cited references. It is also not appropriate to treat any etch-stop material as being suitable for the primary and secondary masks recited in the present invention.

25 Examiner seems to group DRIE and RIE processes together when analyzing the prior art. The fact that a material is used as an etch stop for RIE processes, as in *Mandal*, does not make it suitable for use as a mask for DRIE processes, and does not qualify them as "DRIE-resistant materials" as required by independent Claims 1 and 11. This fact is emphasized by the use of a RIE-resistant material as a primary mask on top of DRIE-resistant material, as in claim 1, in order to pattern 30 the DRIE-resistant secondary mask. The DRJE-resistant material is not resistant to

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RIE, or else it could not be patterned by the RIE using the primary RIE-resistant mask, and there would be no need for two different masking materials. The fact that an RIE-resistant material is found in the *Mandal* reference has no bearing on the present invention.

5 Likewise, the enumeration of multiple methods of etching with regard to the structure in Fig. 4 of *Halahan*, which includes DRIE, does not imply that the structure shown in Figure 15 shows a DRIE-resistant material used as a mask. In fact, it is clear that the TiW material indicated by the Examiner as “DRIE-resistant material” could not actually perform that function. First, the material is unsuited as
10 a DRIE mask, and is in fact not a material that one skilled in the art would identify as “DRIE-resistant material”. Second, if it were a DRIE-resistant material, it would be not be used in the manner indicated. There is simply no reason to coat an entire surface with DRIE-resistant material, and then apply DRIE to it without somehow patterning the DRIE-resistant material first, as does the present invention
15 by use of a primary RIE-resistant material. Figures 15 and 16 of *Halahan* show this very clearly, as does the description in Col. 8, Ln 62-65:

“Seed layers 1010.2, 1010.1 and dielectric 120 are etched away through the hole in resist 1110. Then the resist 1110 and the seed layers 1010.2 and 1010.1” (emphasis added) “are stripped away. The resulting structure is shown in Fig. 16.”

20 If the etching process is taken to be DRIE, there is no hint that layers 1010.1 and 1010.2 are meant to be DRIE-resistant. They are not patterned by the DRIE, or any other process, they are merely etched away. It was never their function to act as masks. They were intended as seed layers, as stated. It is thus inappropriate
25 to refer to the seed layer material of 1010.2, 1010.1 as any sort of “mask”, since in its first exposure to the etching process, it is etched away.

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There is no teaching or implication by *Halahan* to use first RIE to pattern a secondary mask and then DRIE processing to pattern the Si material through the secondary mask.

Examiner has further stated”

5

“In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based combinations of references....”

10 Examiner has stated that a combination of references cannot be attacked by attacking one reference alone. However, an obviousness rejection is proper only if all of the claimed elements are found in at least one of the cited references. In the present case, the claimed elements of an RIE-resistant material primary mask on a DRIE-resistant material secondary mask, and more specifically Al₂O₃ as the DRIE-
15 resistant material, are not found in any of the any of the references cited, either singly or in combination. At the very least, unless these elements are found in at least one of the references, it cannot be fairly said that the claims are obvious in view of the combination of references.

20 Applicant respectfully requests that all rejections as to existing Claims 1-4, 6-14 and 16-20 be withdrawn and these claims be allowed.

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Conclusion:

Applicant has endeavored to put this case into complete condition for allowance. It is thought that the §103 rejections have been corrected by 5 amendment or were unfounded on the references cited. Applicant therefore respectfully asks that the rejections be withdrawn and that allowance of all claims presently in the case now be granted.

If the Examiner would like to discuss any of the points involved in the Response, she is urged to contact Applicant's Attorney at the numbers included 10 below.

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